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Distributed Generation (DG)

Natural Gas Technology Conference

Houston, Texas

May 14, 2002

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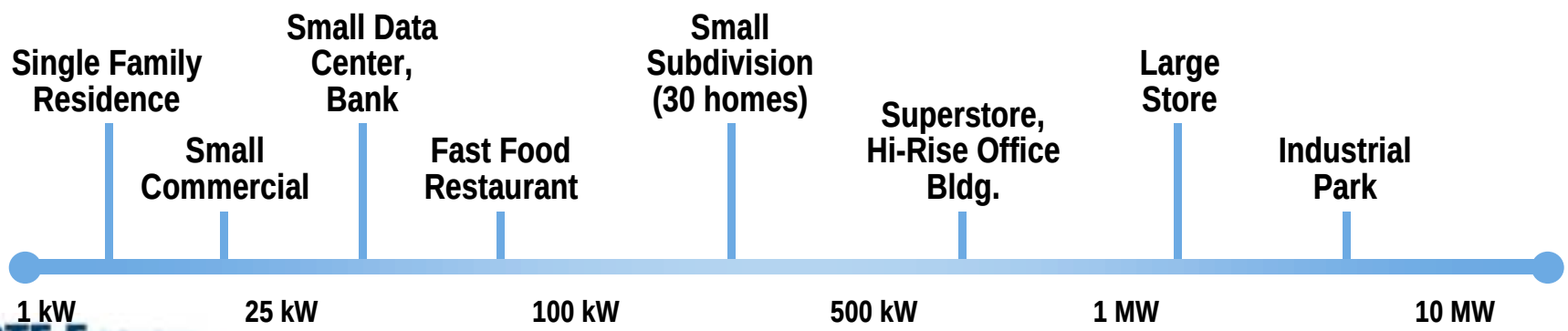
What is Distributed Generation?

"Integrated or standalone use of small modular electric generation close to the point of consumption"

-- *Arthur D. Little*



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Applications and Markets

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Applications	*Potential Markets*
Remote Locations • Off-grid Sites	• Gas Extraction/Pipeline • Agriculture • Military/Defense
Mobile Generation • Generation Moved Site-to-site	• Utilities in Deregulating Markets • Military • Seasonal Venues • Media
Micro Cogen • Generation Power and Heat	**Commercial Establishments** • Supermarkets • Hospitals • Schools • Prisons • Fitness Centers • Office/Commercial • Hotel/Resorts • Hair Salons

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Applications and Markets (cont'd)

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Applications → ***Potential Markets***

Microgrids

- Multiple Purpose Power for Small "Neighborhood" Grid

→

- New Housing Developments
- Industrial Parks
- Utilities with Pockets of High Growth

Uninterruptible Power

- Isolated onsite power for critical loads

→

- Telecommunications Hubs
- Web Hosting/Server Farms
- Software
- Quality–intensive Manufacturing
- Financial

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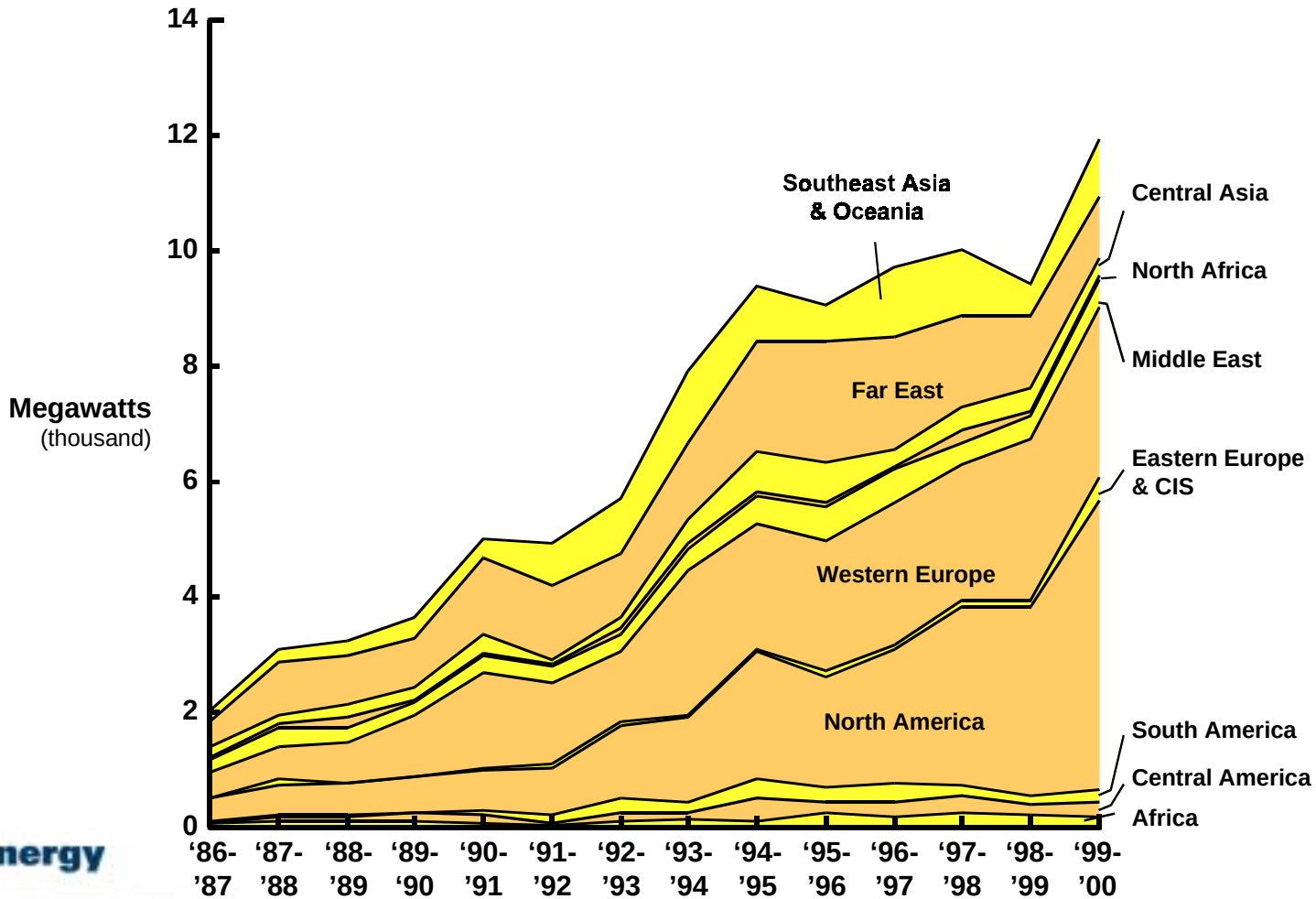
Orders for Generating Equipment 1–10 MW



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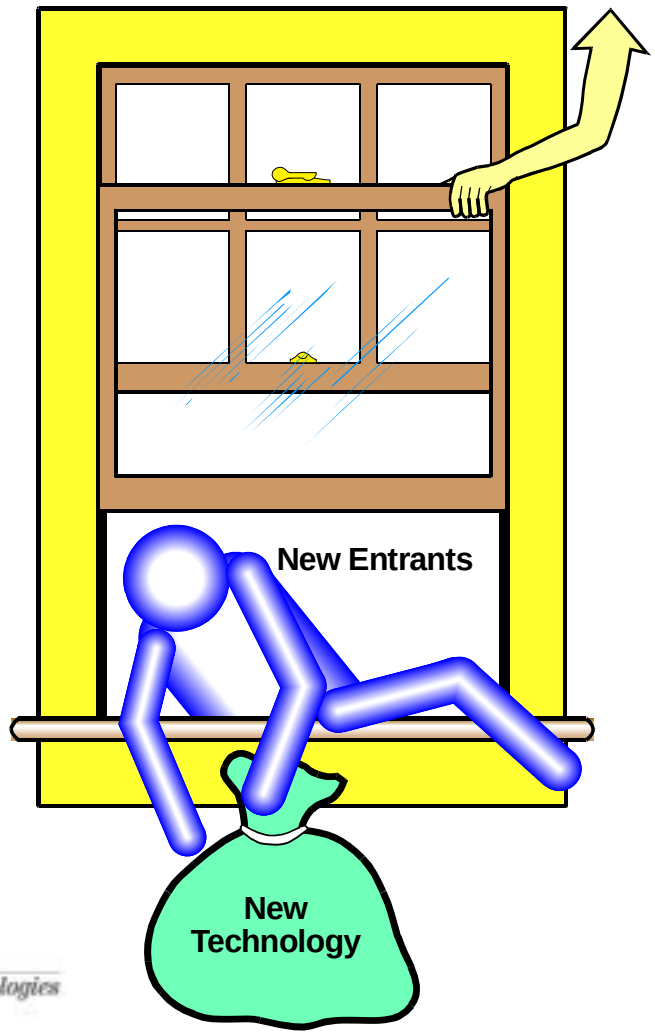
DG Window of Opportunity



- Utility restructuring
- Rapid economic and load growth
- Aging infrastructure
- Environmental movement
- Capital availability
- Capacity shortages
- Transmission gridlock
- Extreme weather
- Global competition and the drive for productivity
- Increasing use of computers and telecom
- Home offices
- Security

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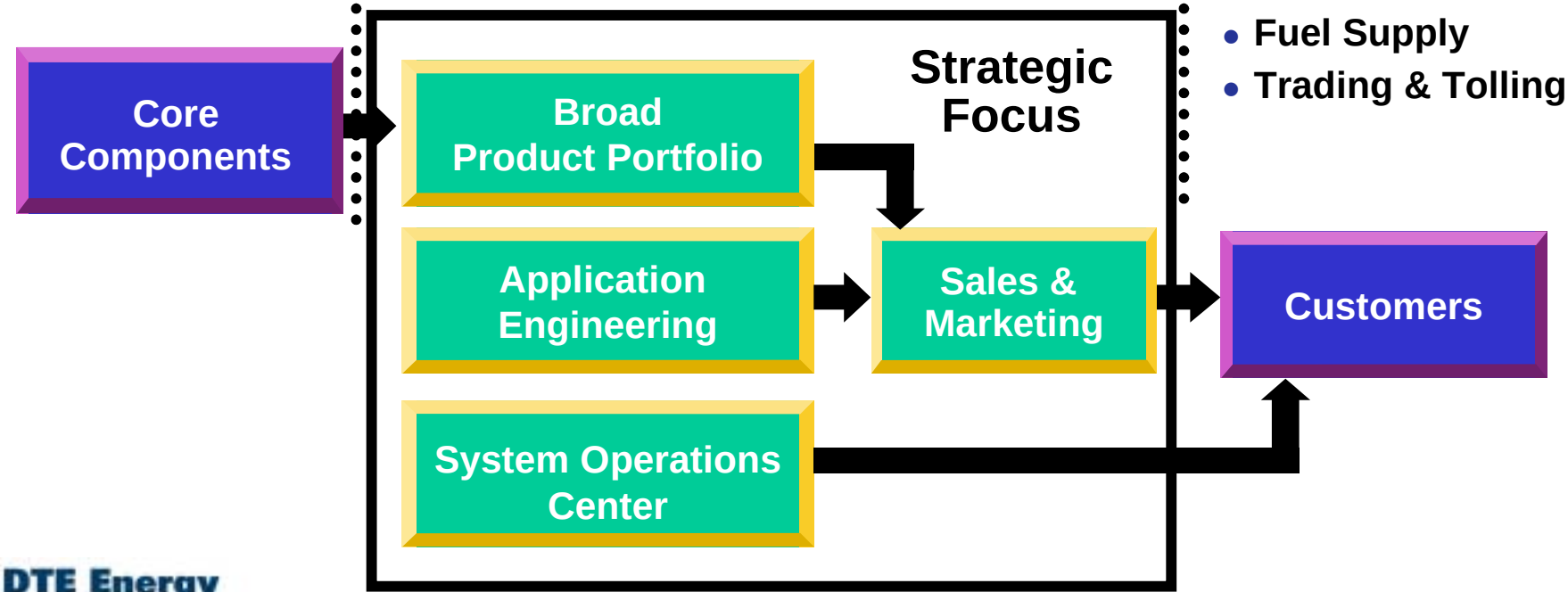
Role of DTE Technologies (d|tech)

Partners provide:
- Core Components
- Manufacturing

Integrate technologies & provide one-stop, hassle-free, transparent DG solutions

Partners provide:
- Financing
- Installation & Maintenance
- Fuel Supply
- Trading & Tolling



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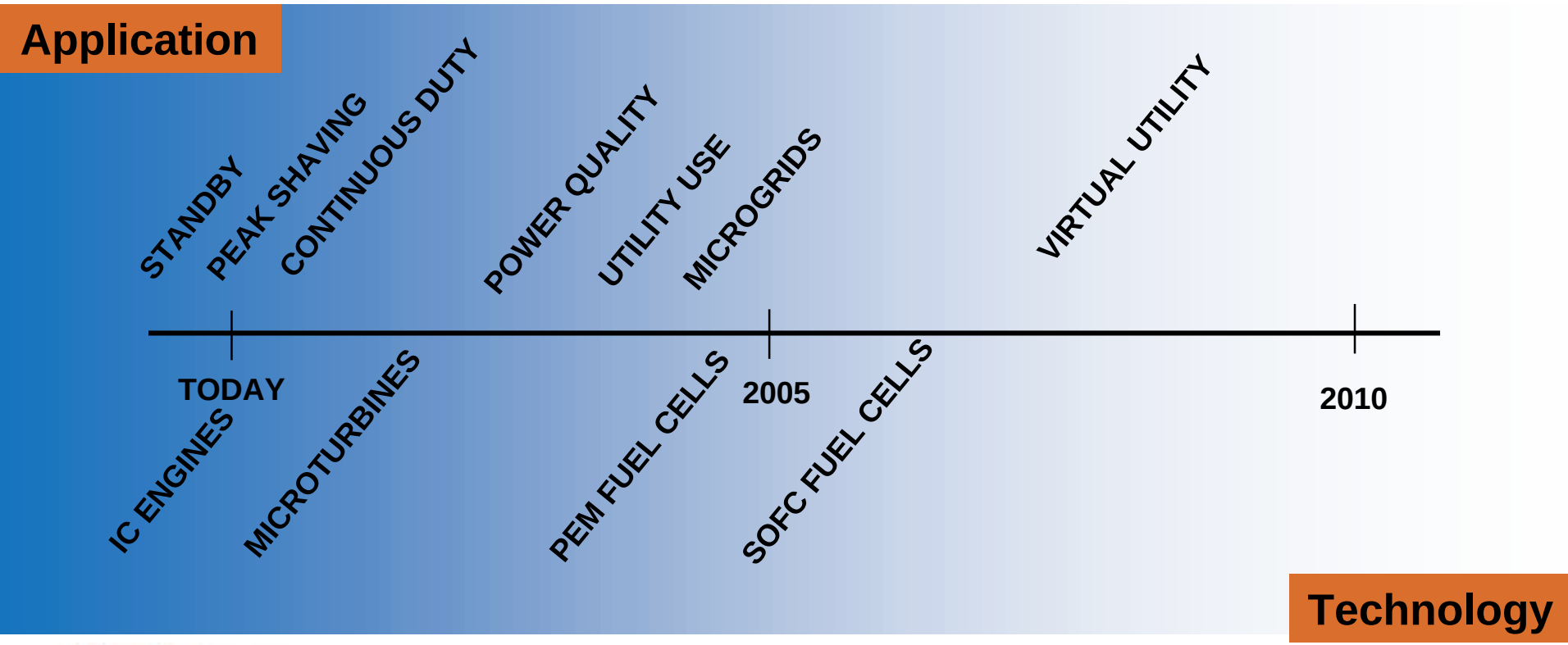
DG Timeline



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Microturbines and Fuel Cells

- Benefits
  - High Reliability
  - Low Maintenance
  - High Co-generation Efficiencies
  - LOW EMISSIONS

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Emissions Comparison

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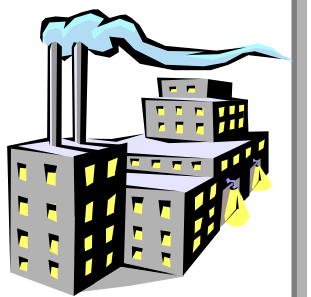
	Coal Fired Power Plant	Fuel Cell
		
NO_x	0.48 lb / MMBTU	< 0.00004 lb / MMBTU
SO_2	1.2 lb / MMBTU	<0.00004 lb / MMBTU
CO_2	205 lb / MMBTU	117 lb/ MMBTU, with reformer

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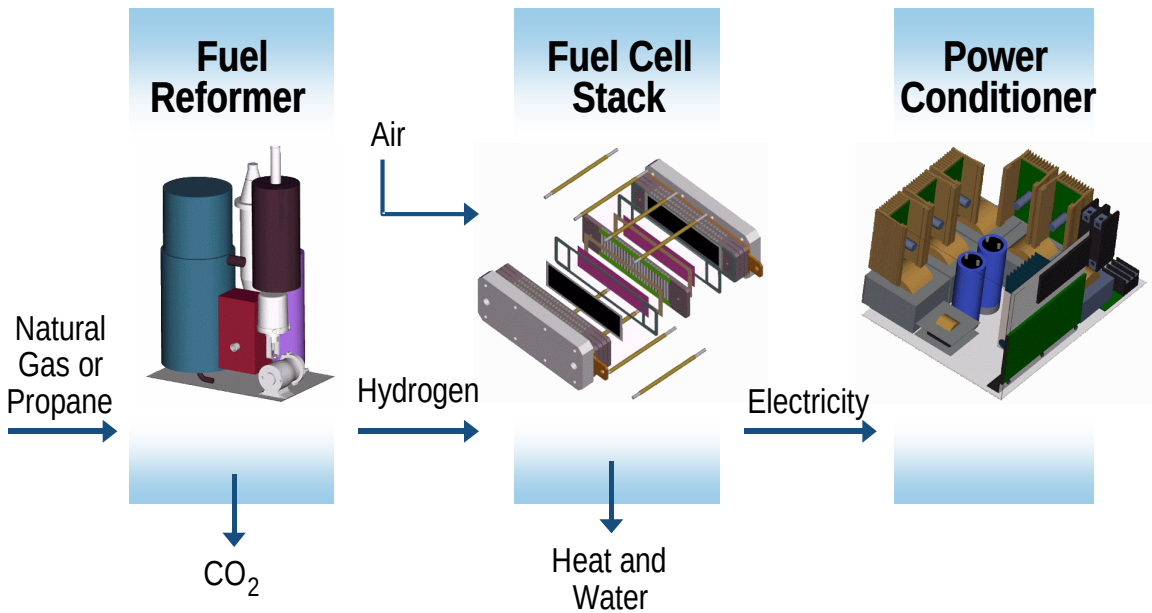
Fuel Cells

- **Proton Exchange Membrane (PEM)**
- **Solid Oxide (SOFC)**
- **Phosphoric Acid (PAFC)**
- **Molten Carbonate (MCFC)**
- **Alkaline (AFC)**



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Cost of Centralized and Distributed Generating Options

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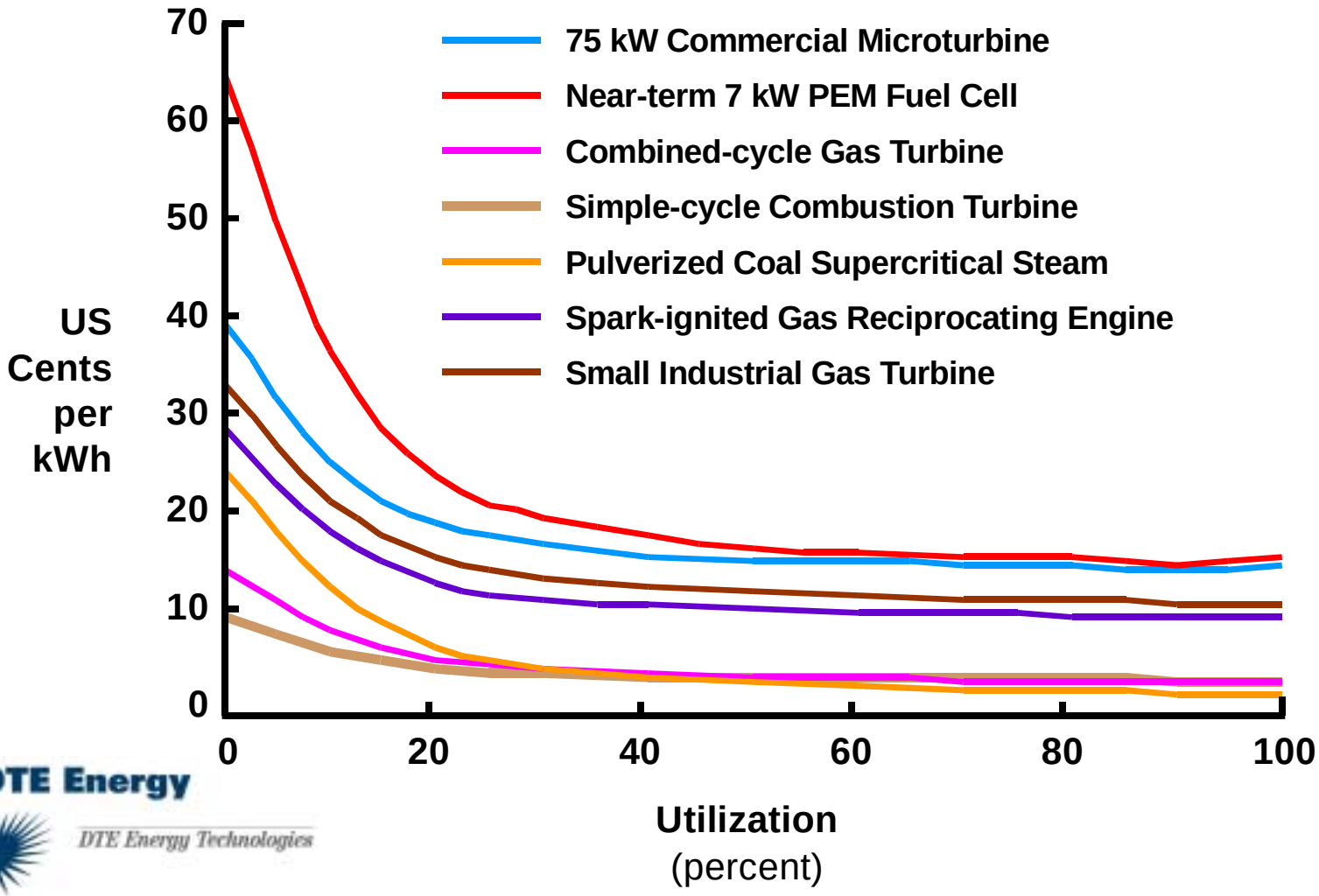

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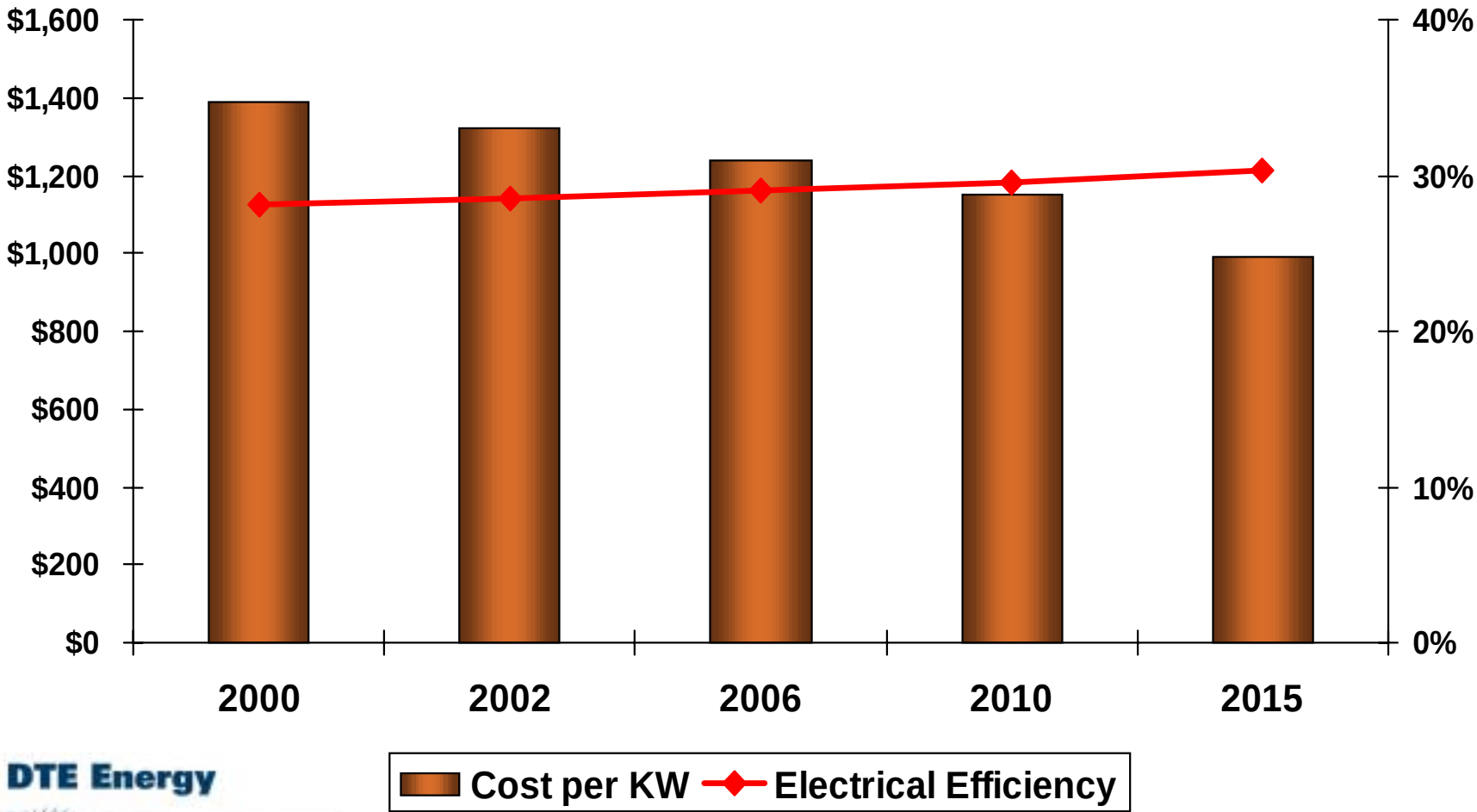
Gas Engine Cost and Performance Assumptions



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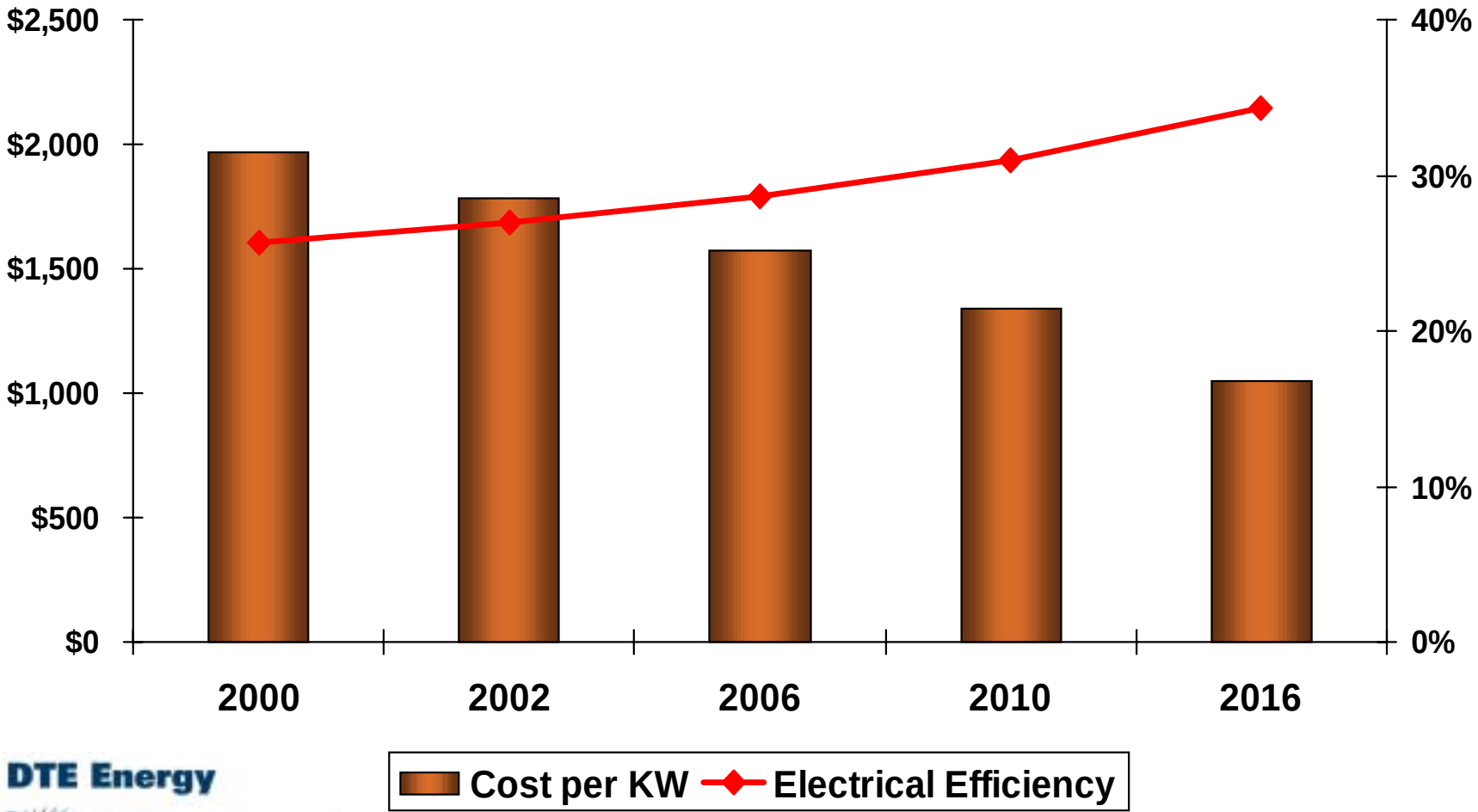
Gas Micro-Turbine Cost and Performance Assumptions



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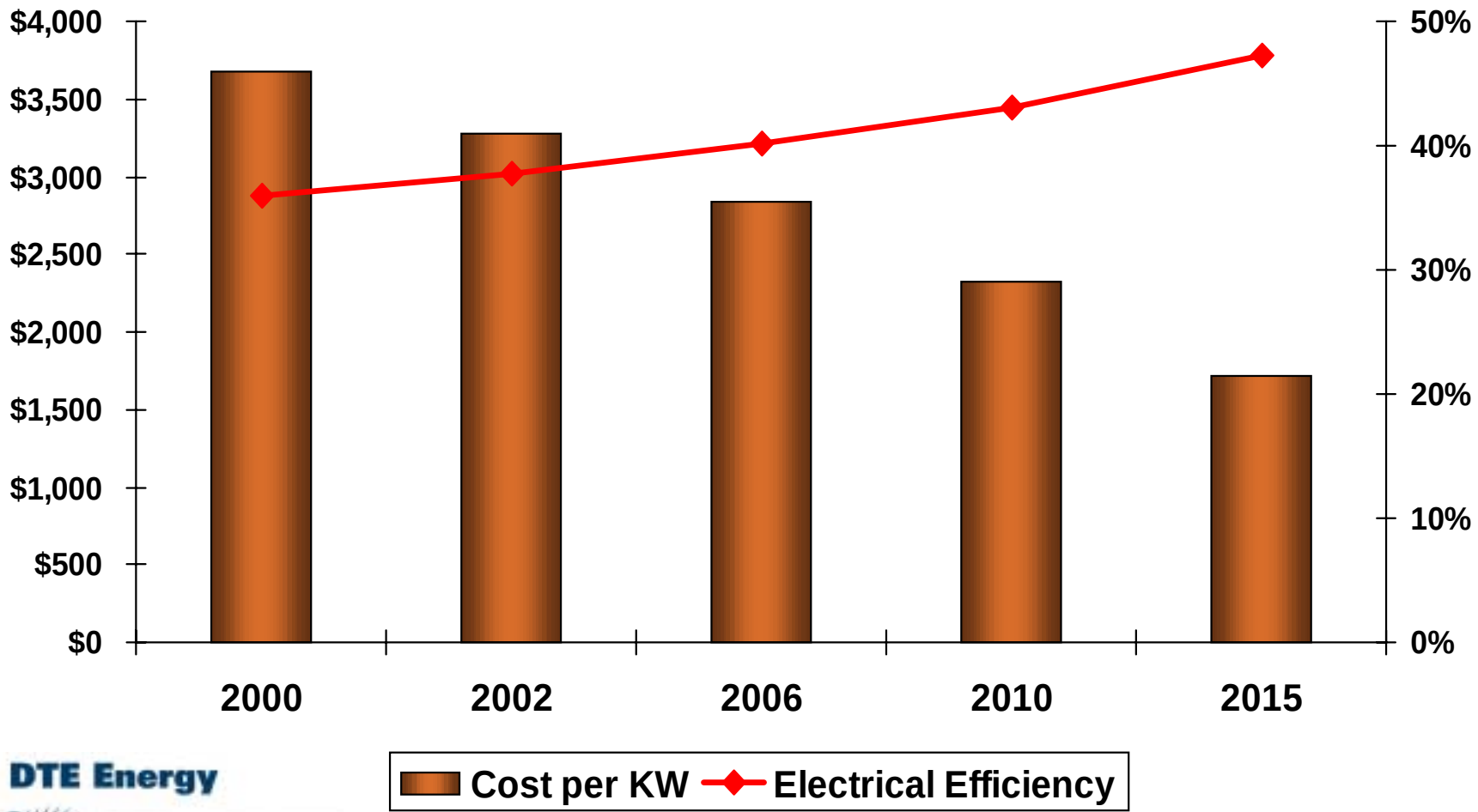
Fuel Cell Cost and Performance Assumptions



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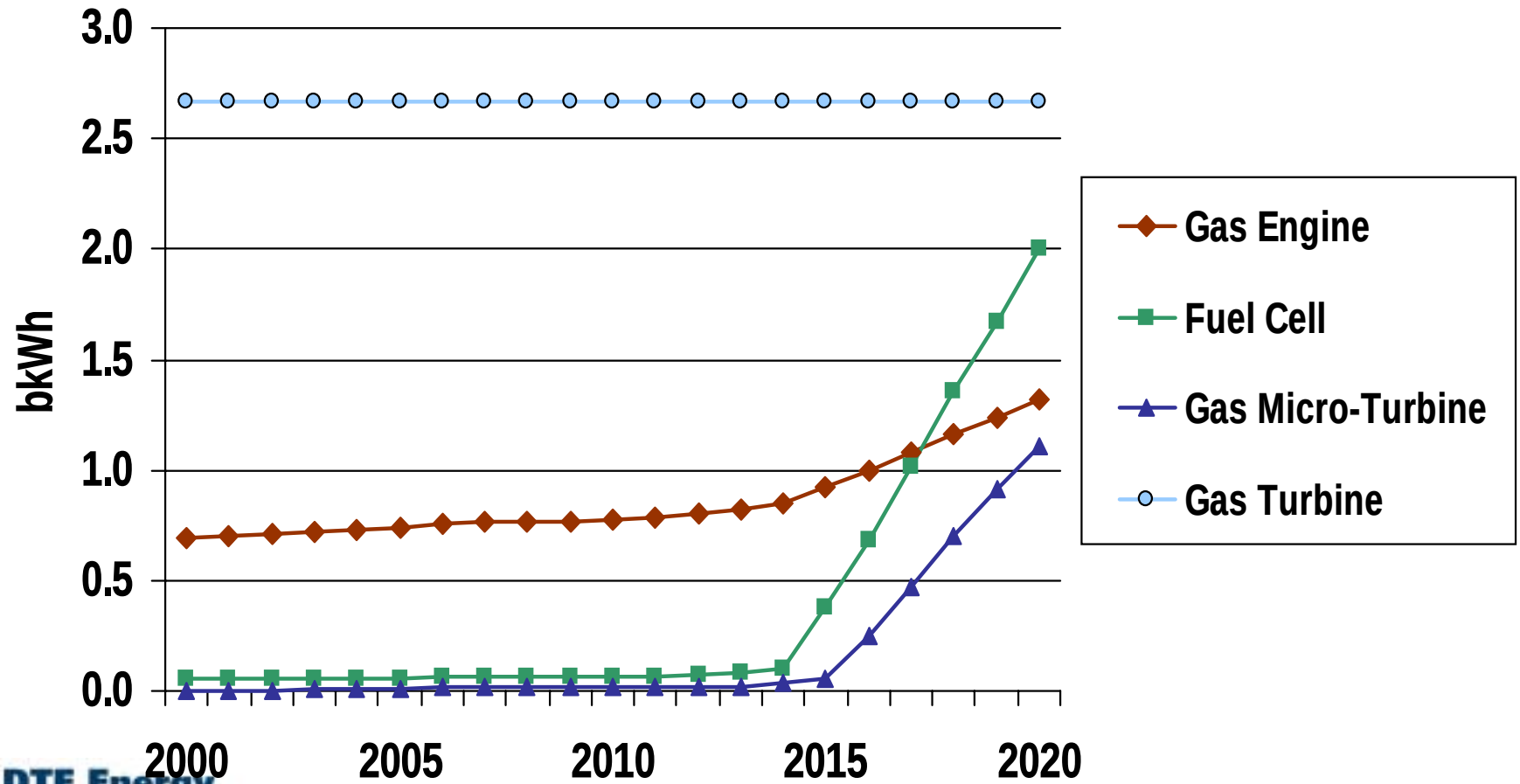
Electric Production Projections



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Market Drivers & Barriers

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Market Drivers	Market Barriers

• Need for more reliable power
• Need for higher quality power
• Reduce impact of power consumption on the environment
• Security and independence from electric utility
	• Technology Risk
	• Requires new business models and new customer paradigms
	• Electric Utility 0pposition
	  • Interconnection
	  • Exit fees
	  • Standby Charges
	• Natural Gas Prices

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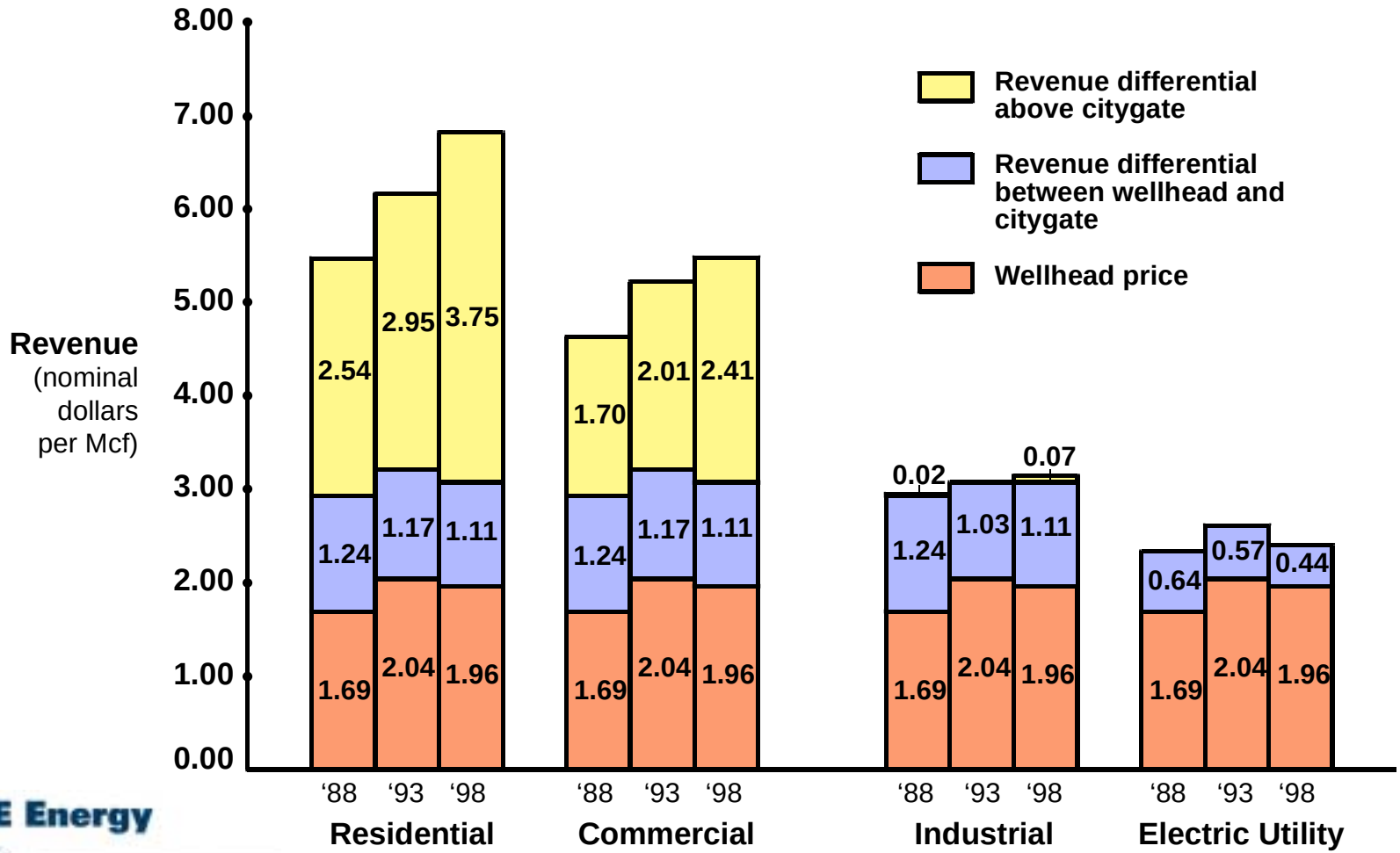
US Natural Gas Pricing Along the Value Chain



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D|Tech's Vision of DG

Traditional
Electric System

Traditional Electric System
+
Personalized Power through Distributed Generation (DG)

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